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FIFTH ALL-UNION CONFERENCE ON THE APPLICATION OF TRACE ELEMENTS IN AGRICULTURE AND MEDICINE (IRKUTSK, 15-20 AUGUST 1966)

[Following is a translation of an article by V.A. Burkin and G.Ya. Zhiznevskaya from the Russian-language periodical Fiziologiya Rasteniy (Plant Physiology), Vol. 14, No.5, Moscow, September-October 1967, pages 957-959]

The Fifth All-Union Conference on Trace Elements held in Irkutsk was organized by the Scientific Council on Trace Elements in Plant Cultivation and Animal Husbandry at the Division of Biochemistry, Biophysics and Chemistry of Physiologically Active Compounds of the Academy of Sciences USSR and the Commission on the Study of Trace Elements, Buryat Complex Scientific Research Institute and Eastern Siberian Biological Institute of the Siberian Division, Academy of Sciences USSR. The Irkutsk conference was exclusively representational. Representatives of many branches of science participated. Physiologist, biochemists, agricultural chemists, agronomists, soil scientists, geologists, physicians, veterinarians, chemists, physicists, as well as workers in other fields of knowledge attended, coming from all areas of the Soviet Union. There were 390 reports read at the conference, of which 11 were delivered at the plenary sessions and the remainder at sectional meetings. In the introductory address, Academician N.M. Shemyakin dwelled on the achievements of scientific research organizations in learning about the role of micronutrients in the life processes of organisms, as well as in the distribution of micronutrients in the biosphere. Later, in the plenary sessions, the following reports were

heard: Academician Ya.V. Peyve spoke about "The Role of Micronutrients in the National Economy of the USSR", Professor M.Ya. Shkol'nik about "The Physiological Role of Micronutrients in the Light of the Latest Progress", Professor O.V. Makeyev "Micronutrients in Siberia" (on regularities of micronutrient distribution in the biosphere and their effective use in agriculture and medicine), Academician of the Academy of Sciences, Ukrainian SSR, P.A. Vlasyuk "The Physiological Role of Micronutrients and Their Value in Plant Cultivation", Professor M.V. Katalymov (Scientific Research Institute of Fertilizers and Insectifuges imeni Ya.V. Samoylov) "Concerning Promising Forms of Microfertilizer" and Candidate in Biological Sciences A.L. Kovalevskiy (Buryat Complex Scientific Research Institute, Siberian Division, Academy of Sciences USSR) on the topic "Biogeochemical Research and Mineral Prospecting in the USSR".

The final plenary session was devoted to methodological questions. The participants of the conference listened with the greatest interest to a report by Academician V.A. Kargin on "Multiple Cell High Voltage Electrodialysis as a Method of Determining Microadditives". Also heard was a report by N.G. Zyrin (Moscow State University) on "Physico-chemical Methods of Analyzing Micronutrients". G.Ya. Rinkis (Institute of Biology, Academy of Sciences Latvian SSR) explained in detail chemical methods of determining micronutrients, and Professor Arnautov discussed quantometric methods of analysis. S.A. Shipitsyn (Irkutsk University) discussed the application of spectral analytic methods in biogeochemistry. A special lecture was devoted to mathematical processing of the results of biogeochemical research (R.I.Dubov, Institute of Geochemistry, Siberian Division, Academy of Sciences USSR).

Eight sections or panels were organized to hear the remaining reports: 1. Micronutrients in the Biosphere; 2. Micronutrient Biochemistry and Physiology of Plants; 3. Micronutrients in Plant Cultivation; 4. Micronutrient Biochemistry and Physiology of Animal and Human Organisms; 5. Micronutrients in Animal Husbandry; 6. Micronutrients in Medicine; 7. Biogeochemical Research in Mineral Prospecting; 8. Micronutrient Research Methods.

At the sessions of the panel on "Micronutrient Biochemistry and Physiology of Plants" 47 reports were read.

Academician Ya.V. Peyve (Institute of Plant Physiology, Academy of Sciences USSR) in his speech on "The Role of Metals in Biochemical Processes that are Catalyzed by Enzymes" dwelled basically on research in molybdenum, copper and cobalt participation in enzymatic systems associated with the fixation of atmospheric nitrogen in the tubers of leguminous crops. Professor M.Ya. Shkol'nik (Botanical Institute, Academy of Sciences USSR) set forth in great detail the problem of the plant physiological role of boron, discussed the latest literature and his own experimental data relating to the connection between boron and nuclein, auxin exchanges, as well as with phenolic growth regulators.

In the report of Z.M. Klimovitskaya, A.D. Lendenskaya and E.V. Rudakova (Institute of Plant Physiology, Academy of Sciences, Ukrainian SSR) "A Study of the Physiological and Biochemical Role of Micronutrients in Cells" and in the report of Academician of the Academy of Sciences Ukrainian SSR P.A. Vlasyuk "The Physiological Significance of Manganese in Plants" the results were presented of important new research on the localization of the micronutrients molybdenum, zinc, manganese in plant intra_cellular structures. Academician Vlasyuk also reported on investigations which he had made on the role of manganese ions in plants using the paramagnetic resonance method.

G.R. Ozolinya (Institute of Biology, Academy of Sciences, Latvian SSR) thoroughly characterized the status of the role of micronutrients in nuclein exchange and also treated the results of his own experimental research into the participation of copper in the biosynthesis of DNA in plants.

The report of G.Ya. Zhiznevskaya (Institute of Plant Physiology, Academy of Sciences USSR) explored the role of copper in plant nitrogen metabolism.

B.A. Yagodin (Institute of Plant Physiology, Academy of Sciences USSR) presented the results of his study on the biochemical role of cobalt in plant life. He established the significant stimulating activity of prosowing treatment of leguminous fodder seeds with cobalt on the activity of hydrogen-donor nitrogen fixation systems, as well as the hemoglobin and vitamin B12 content in tubers.

The report of T.A. Paribok (Botanical Institute, Academy of Sciences USSR) presented his original data on

the influence of zinc on respiration and oxidation phosphorylation in plant leaf mitochondria. A.V. Kositsyn (Botanical Institute, Academy of Sciences USSR) reported on research conducted under the direction of M.Ya. Shkol'nik at the research laboratory on intra_cellular localization and forms of zinc in plant tissue.

The Fifth All-Union Conference on Trace Elements held at Irkutsk was characterized by the exceptional attention given to a central problem in plant biochemistry and physiology, namely the study of metallic enzymes.

The participants of the conference were greatly interested in the work performed at a high methodological level (noted in the resolution of the panel) relating to the isolation from plant cells and study of the properties of metalloproteins. A.A. Mutuskin, together with K.V. Pshenova and P.A. Kolesnikov (Institute of Biochemistry, Academy of Sciences USSR) presented an experimental report on the biological activity of protein containing copper and iron, in which a discription was given of the method and results of extracting ferredoxin and plastocyanin from wheat leaves.

A.F. Agafonova (Institute of Plant Physiology, Academy of Sciences USSR) reported on the isolation of phytoferritin from leaves in connection with a study being made of the role of intracomplex iron compounds in plant nutrition.

N.N. Ivanova, together with Ya.V. Peyve, M.G. Shirinskaya and P.N. Dubrovo (Institute of Plant Physiology, Academy of Sciences USSR) reported on the results of extracting and purifying metal-bearing enzymatic preparations of nitrate and nitrite reductase from the leaves and tubers of legumes. A report by R.T. Polikarpochkina (Eastern Siberian Biological Institute, Siberian Division, Academy of Sciences USSR) was devoted to the extraction and purification of glutamic acid dehydrogenase, a zinc-bearing enzyme from corn roots.

The panel resolution cited as a positive development the upswing of studies on the extraction, purification and investigation of properties of the biologically active metalloproteins in plants being conducted at the Institute of Plant Physiology, Academy of Sciences USSR, the Institute of Biochemistry, Academy of Sciences USSR and the Institute of Plant Physiology, Academy of Sciences Ukrainian SSR.

During the four years which have passed since the Fourth All-Union Conference on Trace Elements (micronutrients) there has been an intensification, together with biochemical investigations, of cytophysiological research into the study of the function of individual micronutrients.

As an example of such research there is a report by M.Ya. Shkol'nik (Botanical Institute, Academy of Sciences USSR) "On the Physiological Role of Boron in Plants" and the report by L.K. Ostrovskaya (Institute of Plant Physiology, Academy of Sciences USSR) "Cytophysiological Investigation of Leaf Tissue of Peas Grown under Different Conditions of Iron Nutrition". Electron photomicrograph study of leaf tissue revealed pathological changes in cell ultrastructure in the presence of iron deficiency and excess in the nutrient medium.

The work of the Institute of Plant Physiology, Academy of Sciences Ukrainian SSR and the Botanical Institute, Academy of Sciences USSR on localization of micronutrients in cell structures was deserving of high acclaim.

Great attention was given in the work of the panel to the problem of the interrelation between trace elements and such physiologically active substances as growth regulators (T.A. Krupnikova, Botanical Institute, Academy of Sciences USSR), as well as with regard to the participation of micronutrients in nuclein exchange (V.P. Bozhenko, Botanical Institute, Academy of Sciences USSR).

Our notions about the causes of high molybdenum requirements in plants grown on acid soils have been considerably deepened by the report by Ye.I. Ratner and T.A. Akimochkina (Institute of Plant Physiology, Academy of Sciences USSR) entitled "The Protective Function of Molybdenum in Acidy Peat-Podzolic Soils and Aluminum and Manganese Accumulation in Plants Grown on These Soils". The authors of this paper are of the opinion that the protective action of molybdenum in acidy soils (aside from the antagonistic effect on aluminum and manganese accumulation in plant tissue) may also be expressed in other intracellular processes, particularly in reducing the harmful effect of increased aluminum concentrations on protein synthesis.

Typical of the Irkutsk conference was the broadening of the range of trace elements under physiological study. For instance, studies were presented relating to the influence

of lithium on plant physiological and biochemical processes and productivity (P.A. Vlasyuk and M.F. Okhrimenko, Institute of Plant Physiology, Academy of Sciences Ukrainian SSR), to the effect of iodine on oxygen exchange in grain grasses (V.M. Terent'yev, N.B. Golovneva, Institute of Experimental Botany, Academy of Sciences Belorussian SSR, Minsk), and to the influence of iodine and nickel on the photosynthetic activity of corn plants in Buryat (M.V. Yefimov, V.K. Kashin of the Buryat Complex, Siberian Division, Academy of Sciences USSR).

The audience's interest was stimulated by a number of reports on special plant physiology, the application of trace elements and a study of their physiological role in individual agricultural crops located in different soil and climate zones of the USSR. Among these reports one should mention physiological research on soya, among the important crops in the Far East (V.Ye. Kosmakova, L.T. Prozumenshchikova, Far Eastern University; N.T. Zamula and A.I. Kononovich, Blagoveshchenskiy Agricultural Institute).

At the same time, the panel resolution emphasized the inadequacy of several so-called "physiological" studies, characterized by a random selection of "biochemical indicators" and a low methodological level.

The conference deemed it necessary to "turn the attention of physiologists and biochemists to the need of a thoroughgoing study of the mechanisms which regulate the activity and role of micronutrients in physiological processes and biochemical reactions. Study should be made of their condition in plant tissues, the physiological characteristics and structure of the components of plant tissue which contain trace elements. It is also important to learn about the mechanism by means of which micronutrients are taken up by root systems and leaf surfaces, and the laws governing their transmission to various plant organs".

The conference adopted an open resolution on the reports, approving the work of the Scientific Council on Trace Elements in Plant Cultivation and Animal Husbandry at the Academy of Sciences USSR. Noted were the excellent organization of the Fifth All-Union Conference on Trace Elements of the Siberian Division, Academy of Sciences USSR and the significant scientific achievements of Siberian scientists.

The resolution adopted by the conference noted the need of improved allocation of the latest equipment to the basic trace element research centers and the expediency of setting up problem-solving laboratories on trace elements.

Recognition was given to the need of efficient organization of more specialized conferences on various problems concerning trace elements or symposia on individual trace elements that would encompass specialists from different disciplines, as well as the need for regional conferences according to biogeographical provinces or their groups. It was decided to convene the succeeding Sixth All-Union Conference on Trace Elements at Leningrad in 1970.

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